INTERNATIONAL
TSUNAMI
INFORMATION
CENTER

NEWSLETTER

P.O. Box 3830, Honolulu, Hawaii 96812

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCEANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISION OCEANOGRAFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ

VOLUME X, NUMBER 3
SEPTEMBER 1977

The ITIC Newsletter bring news and information to tsunami researchers, engineers, educators, community protection agencies and governments in 45 countries. We welcome your news, reports, papers, or abstracts.

Indonesian Tsunami of August 19, 1977

Just one year after the disastrous earthquake and tsunami in the Philippines, the south coast of Indonesia and northwest shore of Australia were severely struck. On August 19, a major earthquake occurred in the Java Trench, westward of Sumba Island. The Pacific Tsunami Warning Center (Honolulu Observatory) gave a preliminary epicenter of 10.5° S, 118.8° W, with a Richter magnitude of 7.7. The quake was very widely felt, and caused people in Perth, more than 2000 km southward, to flee from office buildings. A major tsunami was generated and initial press reports indicated waves of possibly 30 meters height on adjacent Indonesian coasts, and 8 meters in Australia.

With the support of IOC and NOAA, and permission of authorities of the Republic of Indonesia, an ITIC team of Sydney Wigen and Dennis Sigrist joined with Indonesian investigators headed by Dr. Susanto, Institute of Meteorology and Geophysics of the Department of Communications. Visits were made to coastal areas on the islands of Sumba, Sumbawa, Lombok, and Bali, in order to survey tsunami damage and runup, and to get first hand accounts from local residents. In addition, an air reconnaissance with slide photography, was made along inaccessible portions of the south coast of Sumba and Sumbawa Islands. Agencies of the Indonesian Army, Search and Rescue, Disaster Relief Co-ordination Team, the Provincial Government, and Medical Teams had already visited accessible coastal communities to bring aid, and assess damage and casualties. These records were supplemented by radio reports from isolated communities. A Search and Rescue team of 19, including a surgeon and 2 nurses, had parachuted into Lunyuk, where more than 100 casualties had occurred. The Ministers of Communications and of Economic Affairs visited severely damaged areas to develop Government relief and recovery programs.

Coastal roads do not exist along the shores of the Lesser Sumba Islands fronting the Java Trench, but with the exception of Sumbawa some communities can be reached by road from the interior. Generally though the south coasts are rugged, except for Bali, and villages are small and scattered. In consequence no major ports were in the seriously struck areas, and casualties thus were relatively low. Incomplete

reports indicate more than 180 known or presumed dead, and 3900 left homeless. Personal losses include homes, fishing boats, and gear.

No tide records were available for the most seriously affected areas in Indonesia. However, on an inaccessible section of Sumbawa Island, a preliminary study indicates that the waves reached at least 15 meters above high tide, and penetrated about 500 meters inland in some valleys. Further studies will be made using satellite imagery, to determine if possible, more accurate values of maximum wave height and runup.

Accounts given of the tsunami by observers at several locations have reasonable consistency. The tsunami arrived on the Indonesian coast about an hour or two after high water, and commenced with a recession that frequently left an additional 100-200 meters of beach exposed. Three large waves followed, at intervals of perhaps 5 minutes or less, the first being the highest and most destructive. A few observers noted continued sea disturbance, but this was not generally recognized. An unusual feature was that between the time of the quake and the tsunami arrival, residents in Sumbawa and Lombok communities heard up to 3 explosive sounds, over a period estimated from a few seconds to a minute or more, and these were described variously as sounding like bombs, aircraft breaking the sound barrier, or thunder. The sound in each case came more or less from the direction of the epicenter. Almost every community reported the water turning black, and some claimed also it increased in temperature and had a bad odor.

Following the Indonesian survey, Mr. Wigen visited Perth in Western Australia. Although because of heavy flight bookings he was unable to visit the northwest coast, he was able through the Departments of Public Works and of Meteorology to obtain tide records from gauging stations, and to receive first hand accounts and reports of people who witnessed the tsunami. Consulting engineering firms working with mining and offshore oil drilling firms also extended much help and co-operation in the investigation.

Reports indicate that on the Australian coast, as in Indonesia, three major waves came in with the first being the largest. The disturbance continued for a number of hours. A wave height of 2 meters was reported at Dampier, 2 to 4 meters at Port Sampson, and 6 meters at Cape Leveque. The tide was falling, and at most places, near low, and this reduced the tsunami impact. There was apparently no loss of life in Australia, though it is reported that at least one person was swept into the sea by the waves.

Technical information on the August 19th tsunami is being compiled and will be published in Tsunami Reports 1977-12, available on request from ITIC.

Volcanic Eruption in Hawaii

Kilauea, one of the active volcanoes on the island of Hawaii, and one of the largest in the world, has been in a state of eruption since September 13. Most activity to date has been located along Kilauea's East Rift Zone, where lava discharge on September 26 was estimated to be 1,000,000 cubic yards per hour. The last previous activity of this volcano was a brief eruption coinciding with the earthquake and tsunami of November 29, 1975. Seismic activity during the present outburst has not been unusually large.

above – Coastal area of Sumbawa Island, near Lunyuk, devastated by August 19, tsunami wave.

below – Lunyuk Village, Sumbawa Island, destroyed by the August 19, tsunami. (Associated Press, Jakarta, Indonesia)

NEWS EVENTS

Tsunami Warning System Coordination Meeting

The Second Tsunami Warning System Coordination Meeting of the U.S. National Weather Service, was hosted by the Alaska Region in Anchorage, August 31 - September 2, 1977. The purposes of the meeting were to review and appraise the status of the U.S. Tsunami program and services, to review the recommendations of the recent U.S. Department of Commerce/NOAA evaluation of the Tsunami Warning System, and to make recommendations that will result in improved operations and services. A total of 25 action items were identified from these discussions.

Present at this meeting were representatives from NWS's Headquarters, Pacific Region, Alaska Region and Western Region, as well as representatives from U.S. National Ocean Survey's Headquarters and the Pacific Tide Party. Dr. George Pararas-Carayannis represented ITIC at this conference and discussed the international aspects of the Pacific Tsunami Warning System and the need for closer cooperation with member states of ITSU, so that the Tsunami Warning System can become more effective and of greater benefit to the entire Pacific community.

UNESCO - IOC - ITSU

ITSU-VI Meeting, Manila, Philippines, 20-25 February 1978

As reported in the June issue of the ITIC Newsletter, the sixth session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ITSU) will take place in Manila, Philippines, on 20-25 February 1978. The Meeting is sponsored by UNESCO's Intergovernmental Oceanographic Commission and will be hosted by the Philippine Government.

Invitations and announcements regarding this meeting, as well as a Provisional Annotated Agenda have been sent by the IOC/Secretary, Mr. Desmond P.D. Scott, to all Member States of the International Co-ordination Group, to the different states which usually send observers, to the Advisory Bodies of the Commission, the Secretary General of WMO, the Presidents of the IUGG Tsunami Committee and the Pacific Science Association, and the Director, Regional Centre of Seismology for South America (CERESIS).

The Member States of the International Co-ordination Group are: Canada, Chile, China, Ecuador, France, Guatemala, Japan, Korea, New Zealand, Peru, Philippines, Singapore, Thailand, USA and USSR. Non-member States interested in Membership in ITSU or in sending observers to the Sixth Session of ITSU may direct their inquiries to: Secretary; Intergovernmental Oceanographic Commission; UNESCO; 7, Place de Fontenoy; 75700 Paris, France.

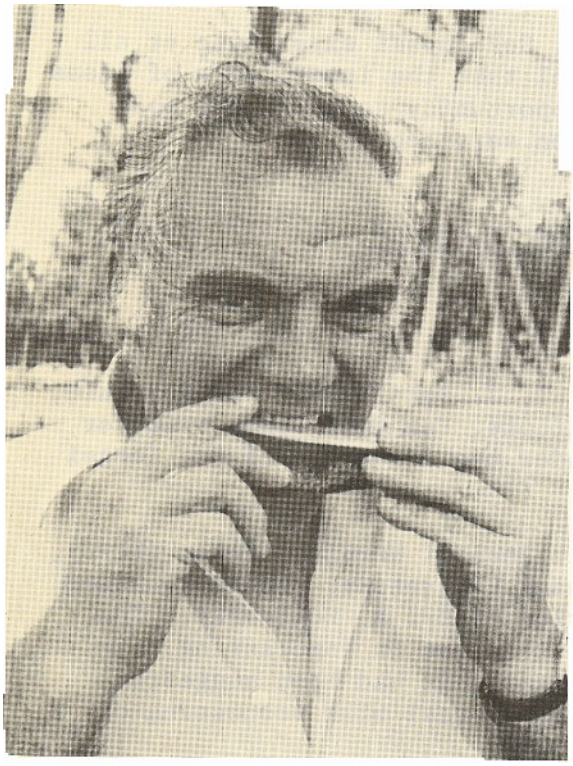
INTERNATIONAL TSUNAMI INFORMATION CENTER

IOC Deputy Secretary Visits ITIC

Dr. Gunter Giermann, Deputy Secretary, Intergovernmental Oceanographic Commission visited ITIC and the Pacific Tsunami Warning Center for two days on the first leg of

a business trip that will take him to the Philippines and the Southwest Pacific. The visit gave an opportunity to see the two Centers in operation, and to hold discussions at ITIC on matters of immediate concern. Principal among these were the Mandate and Functions of ITIC, scheduled for presentation to the 10th Assembly of IOC in October, and the need for a new ITIC Associate Director, with Mr. Wigen already working beyond the limit of his two-year appointment. Discussions covered other items of interest, the agendas of the forthcoming meetings of the IOC Executive Council and Assembly in Paris, and the ITSU VI Meeting in Manila; the status of the resolutions from the last ITSU V Meeting in Lima, Peru; and the working relationships between ITSU, UNESCO-IOC and ITIC. The status of the different ITIC educational programs were discussed, as well as the need to secure international funding for their execution.

Visiting Scientist



Norman M. Ridgway, Physical Oceanographer at New Zealand Oceanographic Institute has completed a 6-week assignment to ITIC, under the Intergovernmental Oceanographic Commission's visiting scient1st program.

During his visit, Mr. Ridgway participated in many of the activities of the Center, and in particular in the systematic collection and compilation of records for the new series, Tsunami Reports. He shared in the preparation of the list of potentially tsunamigenic earthquakes of the last century, to be used in the Historical Study of Tsunamis, and contributed New Zealand data to the list.

Visits were made to the International Tsunami Warning System Center at Honolulu Observatory, the Civil defense Agency's Emergency Headquarters at Diamond Head, and the Hawaii Institute of Geophysics (JTRE). Useful discussions were held and the personal contacts made will be beneficial in both the operational and research aspects of tsunamis in New Zealand.

A study of potential tsunami inundation areas in New Zealand was commented at ITIC. More details of the near-shore land topography than are presently available are required to complete this study. Apart from their usefulness to Civil Defense authorities, the results could also help to alert planners and engineers to the risks posed by possible tsunamis in the siting and design of coastal structures and buildings.

During the final portion o£ the visit, with the Director and Associate Director on overseas assignment, Mr. Ridgway served as Acting Director at ITIC.

EDITORIALS AND LETTERS

I would like to take this opportunity to acknowledge with appreciation the support and hospitality extended to my wife and me during our visits to both the Japan Meteorological Agency (JMA) and the Sakhalin Complex Scientific Research Institute (SKNII). In particular, we would like to express our appreciation to Drs. Hideo Watanabe, Masahiro Kishio, and their staff at JMA; and Drs. Sergei Lappo, Alexander Poplavsky, and their staff at SKNII. This support from both countries has made our trip both productive and an enjoyable one.

Thomas J. Sokolowski
Principal Geophysicist
Pacific Tsunami Warning Center

This scientific and technical visit has now given Mr. Sokolowski experience at all major tsunami warning centers in the Pacific. We feel that the interchange of ideas and developments among the Centers will provide an opportunity to apply the most effective techniques in tsunami warning and protection services.

TSUNAMI WARNING SYSTEM IN THE PACIFIC

US-USSR Tsunami Warning System Exchange Program

During the period of July 24 to August 16, 1977, Mr. T. J. Sokolowski from Honolulu, Hawaii visited the Sakhalin Scientific Research Institute, Far East Science Center of the Academy of Sciences of the USSR, currently under the direction of Dr. Sergei Lappo.

Mr. Sokolowski, Principal Geophysicist of the Pacific Tsunami Warning Center (PTWC), worked with three staff members of the Sakhalin Tsunami Laboratory. These included Drs. A. Ivashchenko and I. Tikhonov under the direction of Dr. A. Poplavsky. The purpose of the visit was to study algorithms for possible use in forecasting tsunamis, and to apply these algorithms to data from Hawaii. It had been suggested that these algorithms could be advantageous to the future real time processing of local earthquakes in Hawaii by the PTWC.

The data for these algorithms were obtained from a single station's three component seismic system. In general, they determine the location of an event and the probability of the generation of a tsunami.

These methods are currently being considered for application in the USSR Tsunami Warning System. However, at the present time, the input digitized seismic data is not automatic and a suitable real time on-site computer is not available. These algorithms have been developed at the Research Institute, using seismic data recorded at the Yuzhno-Sakhalinsk tsunami station, for both tsunamigenic and non-tsunamigenic events from the Kurile Islands region. In order to broaden the possible application of this work, data from areas were required for analysis. The digitized data provided for this study was recorded at the Kipapa station in Honolulu for events generated within the Hawaiian Islands and included all three components for each event.

Initial processing of several events concentrated on aspects such as, seismic event detection, phase arrivals, azimuth determination from recording site to event source, etc., which would lead to the final event location. The initial results were encouraging and the computer programs appear to be suitable for use on a mini-computer. In the future, after complete analysis, these data are intended to be used in evaluating the probability of tsunami generation. Future conversion, of the SKNII supplied software, to the existing computer facilities available to PTWC is intended in completing the study of these algorithms.

Visit to the Japan Meteorological Agency

On July 19-21, Mr. Thomas J. Sokolowski, Principal Geophysicist at the Pacific Tsunami Warning Center, visited the Japan Meteorological Agency's Tsunami Warning Center. This Center must provide regional tsunami warnings in the minimum of time, when large earthquakes occur near the coasts of Japan. The Center is also the communication link with the Pacific Tsunami Warning System. Dr. H. Watanabe and Mr. M. Kishio gave Mr. Sokolowski a comprehensive outline of their tsunami warning procedures, and of the related tsunami projects being conducted by the Agency. A demonstration was made of the tsunami warning procedures from local epicenter location to a simulation of disseminating the warning to the public via radio and TV stations. Once a decision has been made to issue a local warning, the necessary information is handwritten on a form, a facsimile is immediately sent to a communicator (within the same building), and it is disseminated verbally over radio and TV stations.

Dr. M. Ichikawa is applying computer expertise to the warning system procedures. The effectiveness of JMA's tsunami warning services is being enhanced by the application of advanced computer technology.

NATIONAL AND AREA REPORTS

Improved Hawaiian Regional Tsunami Warning System Nears Completion

The U.S. National Weather Service, Pacific Region, is now in the final stages of upgrading the existing Hawaii Regional Tsunami Warning System. As noted in a previous ITIC Newsletter article, the Pacific Region was allocated funds to upgrade and improve the regional tsunami warning system, following the disastrous earthquake and tsunami of November 29, 1975. It is expected this new system will respond effectively to earthquakes and subsequent tsunamis, of local origin.

Much of the electronic equipment ordered earlier in the year has arrived and is now being installed and tested, both in the field and at the Pacific Tsunami Warning Center, located at Ewa Beach, Oahu. As of August 26, 1977, the Honuapo, Kailua-Kona, and Honolulu tide gauges were operational and were being recorded in real-time at the Pacific Tsunami Warning Center. Additionally, tide signals from Hilo on the island of Hawaii, and from Hana on the island of Maui, will be telemetered to the Center and should be operational by the end of this year. The two seismometers operated by the Hawaii Volcano Observatory on the island of Hawaii, which are now tapped by the Pacific Tsunami Warning Center, will be replaced by National Weather Service-owned seismometers at Honuapo and Hilo, and these signals will then be transmitted over the VHF telemetry net.

Upgrading and improvement of equipment at the Pacific Tsunami Warning Center, has included the rehabilitation of the electrical power distribution system as well as the installation of a backup power inverter system. This equipment will provide emergency power in the event that main commercial power fails.

A commercial communications firm has been contracted to install a backup VHF telemetry net for the regional tsunami warning system. This new telemetry will be independent of the present operational net used for the transmission of seismic and tide data, and will become operational in the case of malfunction.

Support provided by NWS staff and technicians, stationed at the Pacific Tsunami Warning Center and at the Regional Headquarters, has been instrumental in making the project a success. Earlier in the year, the National Ocean Survey's Pacific Tide Party was responsible for making the installation of tide gauges at Honuapo, Kailua-Kona, and Hilo, on the Island of Hawaii.

The upgraded regional net will be officially operational by the end of this year.

Earthquake and Tsunami Hazards Reported from Fiji Islands

[The following report is taken in its entirety from the AGID News, April 1977. Although it is written specifically about Fiji, the problems identified have relevance to all tsunami and earthquake areas of the Pacific.]

About 70% of the world's deep focus earthquakes are recorded from the Fiji area, but because they are so deep they do not cause damage on the land surface.

Shallow earthquakes from plate boundary areas can be quite damaging. In 1919 an earthquake of magnitude 8.4 in the Tonga Trench was felt in Tongatapu and Haapai, causing filled ground to settle and a landslide as far away as Samoa. An earlier magnitude 8.7 earthquake in 1917 in the same area caused a lagoon to be uplifted and dried.

A second type of earthquake which can be more damaging occurs along fault zones at or near the earth's surface. Most of these earthquakes are quite small and can only be located by a network of local stations as set up in California and New Zealand. In the south-west Pacific, however, for a long time the only stations that existed were those at Apia, Suva, New Zealand, Australia, and Palau. With these stations it was only possible to locate larger magnitude events which tended to be clustered around plate boundaries only. Meanwhile damaging earthquakes such as the 1953 Suva earthquake (magnitude 6.75) were shown as isolated events on maps without any relation to any known fault zones.

A third type of earthquake is associated with movement of magma beneath active volcanoes. These are often called harmonic tremors and may increase in intensity prior to the eruption of volcanoes. These types of tremors have been recorded in the Hawaiian volcanoes and from seamounts in French Polynesia, and would also be expected from volcanic areas in Tonga, New Hebrides, Solomons, and Papua-New Guinea. However, these are usually of low magnitude with only low local destructive effect and have to be recorded from instruments mounted around active volcanoes.

Suva-Mbengga Seismic Zones

A recent literature and newspaper search revealed that strong earthquakes were felt in the Suva-Kandavu area in the 1850's, in the upper Rewa River area in 1869, at Ovalau in 1919, at Tunuloa, Cakaudrove in 1921, and at southern point of Koro island in 1932. These earthquakes are aligned in a north-easterly direction similar to the Suva-Mbengga zone, indicating the possibility of a fundamental fault running from Mbengga towards Taveuni. However, geological mapping in the Suva area has not yet confirmed the existence of such a fault on land. The 1953, 1961, 1970, and 1975 earthquakes which were felt strongly in Suva were all located in the Suva-Mbengga seismic zone. In addition the Suva seismograph station has recorded about 30 minor earthquakes from this zone during August and September 1976.

The discovery of this active zone so near the densely populated city of Suva has many implications for building codes, town planning, and communications, etc. A detailed study of this zone is necessary to determine the magnitude of danger this presents to Suva and expedite action is necessary from relevant authorities to ensure that proper attention is given to this hazard.

Earthquake Damages

The total duration of a strong earthquake may only be a few seconds but the resulting damage can be devastating. Perhaps the worst and most common calamity is from the collapse of poorly built unreinforced houses such as adobe huts as a result of the earthquakes.

Fires caused by the earthquakes may be devastating. In these cases fire fighting may be difficult as the water mains burst, and firemen may have to resort to pumping seawater and wellwater to stop the fires.

Landslides are frequently triggered off by earthquakes especially in areas of steep hillsides. In filled ground or alluvial areas, fountaining may occur, jetting water several feet into the air. In some fill areas, liquefaction may occur causing the soil to flow like liquid into nearby streams and bays and thereby collapse structures in the area. Power failure, and total loss of communications, are also common.

These situations are all possible in the Fiji Islands. When earthquakes occur in offshore areas they can also create tsunamis (often mistakenly called "tidal waves" as they have nothing to do with tidal effects) and the consequences of these can be just as devastating as the actual earthquake itself.

Tsunamis

Tsunamis are normally caused by vertical fault motion on the ocean floor. In local earthquakes, tsunamis can reach coastal areas within 10 minutes of the earthquake as has occurred frequently in the western Pacific. These waves also travel across the Pacific Ocean at jet speed over deep waters, and tsunamis from Chile have been known to create havoc in Hawaii and Japan.

Most of our islands in the South Pacific have well-developed fringing or barrier reef systems which are an excellent protective barrier against tsunamis. However, tsunamis can affect coastlines which are not well protected by reefs -- for example beaches with a good surf are usually open to the sea. Also in the case of the 1953

Suva tsunami a 30-50-foot wave hit the barrier reef moments after the earthquake and a 6-foot wave then swept across the harbor towards the coastline inflicting considerable damage especially to the wharf and the seawall. Waves from that earthquake also caused casualties at an unprotected village in Kandavu, and was reported at a number of areas in Fiji, and was also recorded on a marigram at Apia. The island of Bougainville was hit by three local tsunamis in 1974 and 1975.

The lesson from this is that in spite of its protective reefs, Fiji Islands may be quite vulnerable to tsunamis of local origin, and perhaps also to tsunamis from other parts of the Pacific.

One problem that has arisen in the study of tsunamis in Fiji is that there is no written record of tsunamis, and so far, it has not been possible to trace any reference to these in legends and dances of Fiji. One reason for this is probably that most people in the past simply did not know what tsunamis were and took any large waves as unusual waves due to distant storms.

Tsunami Warning System in the Pacific

As mentioned earlier tsunamis from any one source travel in all directions over the Pacific at jet speed and can cause considerable damage at any location. As a result of this an International Tsunami Warning System has been set up at Honolulu to warn other Pacific Islands and cities of possible tsunamis from strong Pacific earthquakes. Travel time charts have been drawn for many areas of the Pacific showing the time it would take for tsunamis from any particular location to reach that port. This system has worked well in most cases because of the several hours it takes for these waves to travel the great expanse of the Pacific Ocean.

The only problem with this system is from tsunamis originating in nearby regions. On December 26, 1975, an earthquake of magnitude 7.2 occurred near Samoa at about 4:00 A.M. At 6:00 A.M. a Tsunami Watch from Honolulu was received in the Fiji Islands informing us that the ETA at Suva for the tsunami was 6:10 A.M.! If a large tsunami had occurred, by then it would already have affected the Lau Islands of the Fiji group.

The fault is not with the Honolulu Tsunami Center as it takes a good two hours to communicate with other seismograph stations to locate the epicenter of the earthquake and to calculate its magnitude. What it does show is that for regional earthquakes in the southwest Pacific we may have to organize our own regional network for immediate warning in the event of strong earthquakes within the region.

Warning systems for local tsunamis also need some study in the region.

Earthquake Planning

Much work is needed to determine if active fault zones are present in the various Pacific Islands, and if these zones are found then the frequency and expected maximum magnitudes have to be worked out for planning purposes.

In active seismic areas it is important that building codes reflect the expected maximum acceleration from earthquakes. In this respect it is important that strategic buildings such as communications centers, hospitals, schools, and police be built to withstand even stronger earthquakes. In the Pacific context it should be

noted that the common thatched houses and wooden structures are normally safe in earthquakes.

Town planning becomes important to keep building away from known fault traces, and to ensure that essential services are strategically located. In Fiji, for example, the Suva Fire Station is situated at the end of a dead-end street and at the entrance to that street is an oil depot. In the event of oil fire following an earthquake, it is conceivable that the fire engines might never get out of their dead-end street to fight other fires in the city.

It is important to have capabilities for alternative communications and transport facilities for relief operations in a panic-stricken environment. The value of helicopter availability and mobile radiotelephone units in such situations cannot be overemphasized.

Finally, government authorities should realize that destructive earthquakes might only occur once a century, but it would be best to be able to avoid or minimize the misery of even that one occasion.

..... abstracted from a report prepared by R.N. Richmond, Director of Mineral Development, Fiji Islands. The report was presented at the South Pacific Disaster Preparedness and Relief Seminar held in September 1976 .....

ABSTRACTS AND RESUMES

Geophysical Researches of the Transition Zone from the Asiatic Continent to the Pacific Ocean

Publishing House "Nauka," Moscow, 1977. 156 p.

This publication is a collection of 16 papers, concerned with such Geophysical parameters as crust and upper mantle structures, seismicity, and anomalies of gravity, magnetism, and of travel times. Most of the papers relate to portions of the geographical region Philippines-Japan-Kurils. The publication is in the Russian language, but each paper concludes with an abstract in English.

Tsunami and Internal Waves

Collected papers. Edited by B.A. Nelepo, L.V. Cherkasov, et al. Academy of Sciences (in Russian) 194 p. Price-1rouble.

Contents: Waves from Initial Disturbances

M.V. Babii, V.F. Ivanov, R.A. Yaroshenya. Some results of the calculation of gain coefficients of waves of tsunami type.

A.E. Bukatov. Internal waves from initial disturbances in the ice-covered sea.

V.F. Ivanov. On the Generation of internal waves of tsunami type in an estuary of variable depth and width.

V.F. Ivanov, A.A. Serebryakov, L.V. Cherkesov. Some results of numerical calculations of non-linear waves of tsunami type with regard for dispersion.

V.F. Fedosenko. On the effect of horizontal exchange of momentum on waves arising from initial disturbances.

L.V. Cherkesov, V.F. Ivanov, V.F. Knysh, R.A. Yaroshenya. Some problems of determination of the value of a tsunami wave runup.

Waves from Periodic Disturbances

M.V. Babii, L.V. Cherkesov. On the influence of a frontal zone upon the generation of internal waves.

S.S. Voit, B.I. Sebekin. Investigations of an increase in amplitudes of long waves associated with bottom topography.

V.V. Goncharov. On some peculiarities of internal waves in the ocean.

S.F. Dotsenko. On the radiation of the three-dimensional periodic waves.

L.A. Korneva, V.P. Liverdi. Statistics of distribution and wave spectra in the ocean.

A.N. Lebedev. Kelvin waves in the field of the variable coriolis force.

S.M. Poberezkin. Diffraction of Kelvin internal waves on a slit.

Waves in a Flow

A.E. Bukatov. Gravitational-elastic waves from initial disturbances in a flow of non-uniform fluid.

S.F. Dotsenko, Steady gravitational-elastic three-dimensional waves from travelling disturbances.

S.V. Nesteros, S.Ya.Sekerzh-Zen'kovich. On Kelvin's instability in cylindrical layer of a fluid.

V.S. Potapkin. Steady composite waves at the surface of a stationary flow of a two-layer fluid with a velocity shear.

A.M. Suvorov, L.V. Cherkesov. Generation of internal waves in a shear flow by bottom unevenness.

Theoretical and Experimental Research in Tsunami Problem

Collected papers. Edited by S.L. Soloviev, A.I. Ivashchenko, V.M. Kaystrenko. Publishing House "Nauka," Moscow, 1977. 217 p (in Russian).

Contents:

A.I. Yanushauskas. Oscillations of liquid layer, caused by bottom displacements of short duration.

A.A. Dorfman. Equations of the approximate non-linear dispersive theory of long gravity waves, caused by basin bottom displacements.

A.A. Dorfman. The axisimetric problem for unstationary long waves of finite amplitude, caused by basin bottom displacements.

B.V. Levin, E.V. Sasorova. Some notes on the shock-wave presentation of the tsunami excitation mechanism.

A.N. Lebedev, B.I. Sebekin. Peculiarities of long wave propagation over oceanic basins.

S.S. Voyt, B.I. Sebekin. On the effect of basin bottom topography on the amplification of long waves.

L.A. Ostrovsky, E.N. Pelinovsky. Non-linear evolution of tsunami type waves.

E.N. Pelinovsky. On transformation of solitary wave on the shelf with horizontal bottom.

L.V. Cherkesov, V.V. Knysh. Numerical investigation of non-linear tsunami waves in the basin of varying depth.

K.A. Gorshkov, L.A. Ostrovsky, V.V. Papko, E.N. Pelinovsky. Electro-simulation of liquid surface long waves of finite amplitude.

A.V. Nekrasov. A practical method for computation of long wave reflection from under-water slope.

L.D. Vaingortin, V.A. Karyakin. The variational method of determination of tsunami travel time with taking into account the sphericity of the earth.

V.B. Kardakov. The determination of earthquake source parameters.

V.M. Kaystrenko. On the structure of local dependences for the determination of the source depth and earthquake energy.

A.I. Ivashchenko, V.A. Orlov, A.A. Poplavsky. The problem of tsunami operative forecasting as the pattern recognition problem.

I.N. Tikhonov. Some peculiarities of registration of shear waves from Kurile earthquakes by the "Yuzhno-Sakhalinsk" seismic station.

L.N. Ikonnikova, R.A. Yaroshenya. Tsunami wave refraction calculations for the Pacific Coast of the USSRA.

A.E. Meerson. On calculations of tsunami refraction.

S.L. Soloviev, A.V. Nekrasov, V.G. Bukhteev, R.V. Pyaskovsky. The preliminary tsunami-zonation of the Kurile-Kamchatka coast on the base of hydrodynamic calculations.

N.L. Plink. The study of frequency properties of a shelf with the aim of tsunami-zonation.

N.A. Shchetnikov. On determination of water surface denivellation in tsunami origin.

R.A. Yaroshenya. The investigation of harbour level free oscillations for the Kurile-Kamchatka coast.

Z.K. Grigorash, L.A. Korneva. The investigation of spectral characteristics of mareograms and the determination of total tsunami energy from them.

N.A. Shchetnikov. The North-Kurile tsunami of February 28, 1973.

L.S. Oskorbin, L.N. Poplavskaya, L.S. Shumilina, A.N. Boychuk, N.N. Leonov, V.M. Maslikov, M.I. Rudik, V.A. Ryadov, T.H. Khantaeva. Macroseismic data on the Paramushir earthquake of February 28, 1973.

R.N. Burymskaya. The source mechanism of the main shock, foreshocks and aftershocks of the earthquake of February 28, 1973.

N.A. Shchetnikov. Shikotan tsunamis of June 17 and 24, 1973.

L.S. Oskorbin, L.N. Poplavskaya, A.N. Boychuk, N.D P. Devaykin, N.N. Leonov, M.I. Rudik, M.D. Ferchev, T.N. Khantaeva. Earthquakes of June 17-26, 1973 at the Malaya Kurilskaya Duga area.

ANNOUNCEMENTS

International Symposium on Long Waves in the Ocean; June 6-8, 1978; Ottawa, Canada

This symposium has been scheduled to stimulate exchange of information on current studies and practices in the field of long gravity waves in the ocean. A session on tsunamis is included. For information, write:

Organizing Committee
Long Wave Symposium
Marine Environmental Data Service
Department of Fisheries and Environment
Ottawa K1A OH3, Canada

International Geodynamics Conference; March 13-17, 1978; Tokyo, Japan

The Conference is in two main parts. Part 1 is concerned with present and paleo movement of the plates in the western Pacific-Indonesian Region, and the associated tectonic implications related to the origin and development of the subduction zones and marginal seas.

Part 2 deals with the genesis of magmas in the crust and the upper mantle and their ascent to the earth's surface, and the related volcanic activity. Both sections have direct relevance to the tsunami problems of the Pacific. For information write:

K. Obayashi
Ocean Research Institute
1-15-1, Minami Dai, Nakano-ku
Tokyo 164, Japan

Sixteenth Coastal Engineering Conference; August 28 - September 1, 1978; Hamburg, West Germany

For information write:

Secretary
Coastal Engineering Research Council
412 O'Brien Hall
University of California
Berkeley, California 94720

Special Issues of Marine Geodesy Journal

Two special issues (Vol. 1, No. 4, and Vol. 2, No. 1) of MARINE GEODESY JOURNAL will publish selected papers presented at the 1977 IUGG Tsunami Symposium, Ensenada, Mexico. Special issue Vol. 1, No. 4 will contain papers by Abe, Nakano, Silgado, Farreras, Nakamura and Hulman, book review of tsunami publication, and new publications. Papers by Shaw, Adams, Loomis, Cox, Johnson, Preisendorfer, etc., are planned for Vol. 2, No. 1. The regular issues of the Journal also publish papers on tsunami. Manuscripts for possible publication should be sent to Professor N.K. Saxena, Department of Civil Engineering, University of Illinois, Urbana, Illinois 61801, U.S.A. Subscription order should be made directly to the publisher Crane, Russak & Co., Inc., 347 Madison Avenue, New York, New York, U.S.A.

Seismic Summary (June 23 to Press Time)

The Pacific Tsunami Warning Center has calculated the epicenters and provided the preliminary positions for the earthquakes listed below. Press releases were issued at the time of each investigation. ITIC is investigating for evidence of tsunamis from these events, and those listed in previous issues of the Newsletter. Tsunami Reports will be issued as investigations are completed, and a copy may be obtained by writing ITIC.

Event No.	Event	Location	Action Taken
1977-10	July 21 1346 6.8	Luzon, Philippines 17.0 N 122.4 E	Queried tide stations in Philippines, Guam, Taiwan, New Zealand and Palau Islands
1977-11	July 29 1115 7.3	Coral Sea 12.0 S 153.1 E	Queried tide stations in Papua-New Guinea, Fiji, New Caledonia and Australia
1977-12	Aug 19 0609 7.7	Sumba, Indonesia 10.5 S 118.8 E	ITIC team visited Indonesia and Australia for damage and runup studies. Tide stations queried in India, Sri Lanka, Pakistan, Aden, Tanzania, Malagasy, South Africa, Antarctica, Argentina, Uruguay and Brazil

1977-13	Aug 27 0712 6.3	Banda Sea 8.4 S 125.2 E	Reports sought from Indonesia and Australia
	Aug 31 0042 6.5	Colombia 7.7 N 74.7 W	Inland epicenter No investigation planned
1977-14	Sept 4 0848 6.5	New Hebrides 13.5 S 166.6 E	Queried tide stations in Fiji, New Caledonia, Australia and Papua-New Guinea
1977-15	Sep 4 1541 6.4	Aleutian Islands 51.3 N 178.4 E	Reports sought from Alaska

(left & below) – Tsunami survey party going ashore at Awang, Lombok Island, Indonesia.

(photos: ITIC)